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ABSTRACT

This speech explains the principles of both ceiling radiant heating and cooling systems and describes how these systems achieve climate control. The relative merits of the two basic types of systems are discussed and related to the school environment. (MLF)

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"RADIANT CEILINGS"

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MY SUBJECT IS:
"RADIANT CEILINGS"

A Radiant Ceiling system provides comfort, flexibility, complete use of floor space, with minimum maintenance cost.

The system consists of aluminum panels in a variety of sizes which are heated and cooled by means of water. These panels form the ceiling and are put into almost any type of suspension system. The radiant metal pan can be perforated, providing a sound absorption rating of from 70 to 90 N.R.C. (Noise Reduction Coefficient), it can be unperforated and, silk-screened to match many of the types of acoustical board used to fill out the remaining portion of the ceiling.

Many people comment, after listening to a presentation on radiant ceilings, "I can understand how the radiant cooling works because the cold air would drop from the ceiling; but, I do not understand how you can heat with a radiant ceiling since heat rises". HEAT, does not rise - it is heated gasses such as AIR, which rise. The term "radiant heat" is a misnomer since there is no heat in a radiant wave. There is energy, which converts to heat. For example, the Sun sends no heat to the Earth. It does send radiant waves or energy, which produce heat after the waves strike the Earth. When this energy strikes an object it causes the molecules of the absorbing object to vibrate. This vibration converts the energy into heat. The term "radiant heat" came into broad popular use, and we still continue to use it, keeping in mind that radiant heat in reality refers to the conversion of the radiant energy into heat.

There are three (3) basic types of heat transfer; the first is conducted heat, in which heat is transmitted through the medium of a solid object; the second is convected heat, in which heat is carried by the circulation of air; and, the third is radiant heat, which travels through the air as energy and does not convert to heat until it strikes an object. Another example of radiant energy would be a person lying on the beach with his face in the sand. He is being warmed by energy waves

from the Sun. Suddenly he feels cool and knows immediately, without turning to look, that a cloud has come between him and the Sun. The air temperature remains basically the same, yet he feels cool because his source of radiant heat has been blocked.

How do these facts relate to producing body comfort? The human body functions by constantly taking in fuel, primarily in the form of food, and burning it. In this way the body is constantly generating heat. Actually, it produces an excess of heat. The body is constantly losing this heat by breathing, perspiring, air wiping over the body and by radiation. Therefore, the problem of body comfort is not one of supplying heat to the body, but rather of regulating the heat loss from the body. One of the laws of physics is that, heat flows from the warmer object to the cooler object, and the rate of flow is dependent upon the difference between the temperature of the two surfaces. This, then, explains how you can be comfortable on a cold day when you are surrounded by warm surfaces such as the ceiling, walls and other warm objects. This is because your heat loss is slowed down to the proper rate.

Up to 50% of our body heat is lost by radiation. Therefore, it should follow that a radiant heating and cooling system would be very comfortable.

In the radiant ceiling system, water pipes in contact with the aluminum panels carry either hot or cold water. In the heating system we provide a warm surface which radiates energy to all of the colder surfaces in the room; in the case of cooling, we provide a cool surface to which all of the warm objects in the room - including the glass - radiate their heat.

Because the heating and cooling loads are primarily handled by the ceiling system it is not necessary to put in large quantities of air. Drafts can be eliminated, and

a more even, overall temperature can be maintained throughout every part of the room. With a radiant ceiling the floors are warm.

The radiant-acoustical ceiling gives almost instanteneous response to a change in temperature. This is because the thin aluminim panel does not store up heat such as would be the case if the pipes were either buried in the plaster or in concrete. When you are using radiant heating and cooling, the circulation of a small quantity of air is required. This air is required for ventilation purposes to meet minimum code requirements for odor control, and on the cooling cycle the air must handle all of the latent load so that there is no danger of condensation on the cool ceiling panel. By cutting down on the amount of air required, the associated noise with some air systems is reduced. Since the heat is coming from the ceiling and warming the floors and walls, there isn't the problem of having a very hot area along the perimeter which has a tendency to make it uncomfortable for those who are sitting close to the wall, while those sitting away from the wall might not feel warm enough.

There are two (2) basic types of systems...the so-called "Standard System", which uses standard $\frac{1}{2}$" galvanized pipe welded into a coil with 1'x2' panels clamped to this pipe. For heating this has been quite adequate because you can raise the temperature of the water to produce almost any amount of heating required On cooling, this may be somewhat inadequate if large amounts of glass are present. The second type of system is called the "Modular High Performance System". This particular system uses aluminum panel onto which is metallurgically bonded a copper tubing on approximately 4" centers. The heat transfer here would be much greater, perhaps two or three times the cooling effect as compared to the Standard System. These high performance panels come in a range of sizes from

24"x24" up to 36"x60" in increments of 6" in either direction. They are very flexible in the field where they can be cut to fit into mouldings; grilles or light fixtures can readily be installed in these panels. As you can see, the application in schools would be primarily in perimeter classrooms, and in swimming pool areas. There are schools where radiant has been installed and operating satisfactorily for many years. A radiant ceiling provides a comfortable environment in the classroom and allows outside walls to be used for blackboards, bookshelves or other uses. In nursery rooms and kindergartens, the floors are warm for kids to play on. In swimming pools, there are usually outside walls. In winter, swimmers emerging from the water are chilled because they lose heat by evaporation, convection and radiation to a cold wall. A radiant ceiling warms the walls and floors so that the swimmer feels more comfortable when out of the water.

Generally, first costs will be about the same as other means of conditioning the school, and operating costs should represent a substantial savings each year.

There are also health aspects to consider and in this respect I can tell you the majority of our business over the years has been in patient bedroom areas in hospitals. Perimeter areas of office buildings are another good application for Airtex Radiant-Acoustical Ceilings for comfort and flexibility.

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